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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/707,047	11/18/2003	Tien-Jen Cheng	FIS920030278US1	1046
29371	7590	05/04/2006	EXAMINER	
CANTOR COLBURN LLP - IBM FISHKILL 55 GRIFFIN ROAD SOUTH BLOOMFIELD, CT 06002			VAN, LUAN V	
			ART UNIT	PAPER NUMBER
			1753	

DATE MAILED: 05/04/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 10/707,047	Applicant(s) CHENG ET AL.	
	Examiner Luan V. Van	Art Unit 1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on April 10, 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on April 10, 2006 has been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1, 2, 4, 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nye et al. in view of Collins.

Regarding claims 1 and 6, Nye et al. teach a method for selective electroplating an interconnection pad, the method comprising: forming a titanium-tungsten (TiW) layer (column 6 lines 47-55) over a passivation layer on a semiconductor substrate, said TiW layer further extending into an opening formed in said passivation layer for exposing the interconnection pad, such that said TiW layer covers sidewalls of said opening and a top surface of the pad; forming a seed layer (column 6 lines 47-55) over said TiW layer, selectively removing portions of said seed layer (column 7 lines 35-37) such that remaining seed layer material corresponds to a desired location of interconnect metallurgy for the interconnection pad; and electroplating at least one metal layer over said remaining seed layer material (column 7 lines 55-67), using said TiW layer as a conductive electroplating medium. Further, Nye et al. teach the copper seed layer is patterned by depositing a blanket layer and subtractively etching it using a resist mask (column 7 lines 35-37). The solder is then selectively electroplated on the remaining seed layer in the subsequent step.

Nye et al. differs from the instant claims in that the reference does not explicitly teach electroplating a metal without a photoresist mask.

However, it is well known in the art to selectively electroplate a metal without a photoresist mask. For example, Collins teaches a method of depositing a first conductive material on the workpiece to form an electrically conductive contact layer that conforms to submicron recesses in the workpiece and then disposing a second conductive layer on the contact layer to form a seed layer. The method also includes forming a contact region around a perimeter portion of the workpiece that is defined by

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an exposed portion of the contact layer extending radially inwardly from an edge of the workpiece. The method continues by electroplating additional material onto the seed layer in a plating process that includes engaging an electrical contact directly with the contact region and applying a current directly to the contact region in the presence of an electroplating solution. (Column 3 lines 36-51). The first layer 110 can be a barrier layer composed of tantalum, tungsten, a titanium-tungsten alloy, or other suitable materials that provide good adhesion to the dielectric layer 104 and inhibit migration of bulk fill material to the dielectric layer 104 and/or the substrate 102. (Column 5 lines 16-20). Collins further teaches the seed layer is photolithographically patterned such that the remaining seed layer material corresponds to a desired location of an interconnect opening (Fig. 6C). The workpiece in Fig. 6C with the patterned seed layer is electroplated using the TiW barrier layer as the conducting layer (column 7 lines 63-64). The electroplated metal would inherently encapsulate the exposed outer sidewalls of the seed layer, since the structure of Collins is the same as that of the instant claim.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Nye et al. by electroplating a selected area without a photoresist mask as taught by Collins, because a skilled artisan would have recognized that metal is electrodeposited only onto the seed layer when using a titanium tungsten barrier layer, thus electroplating a selected area without a photoresist mask as taught by Collins would be a suitable alternative method for selective plating of an interconnect opening.

Regarding claim 2, Nye et al. teach the seed layer further comprises a Cu/CrCu layer (column 6 lines 47-55).

Regarding claim 4, Nye et al. teach removing portions of said TiW layer not covered by said at least one metal layer following electroplating thereof (column 8 lines 24-27).

Regarding claim 7, Nye et al. teach the passivation layer further comprises a photosensitive polyimide (PSPI) layer (column 7 lines 7-11).

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nye et al. in view of Collins, and further in view of Love et al.

Nye et al. and Collins teach the method as described above in addressing claim 1. Nye et al. also teach that nickel can be used in addition to copper (column 10 lines 15-18) for bonding the CrCu layer and the gold layer (column 4 lines 35-38). The difference between the reference to Nye et al. and the instant claims is that the reference does not explicitly teach electroplating a nickel or the gold layer.

It is well known in the art that nickel and gold can be electroplated, and that the nickel and gold layer are deposited between the copper and the solder material. Love et al., for example, teach that the nickel layer acts as a barrier to any solder-copper chemical interactions (column 9 lines 33-25), and that gold is plated on the nickel layer to protect it from environmental corrosion and attack, since the nickel layer is susceptible to oxidation (column 24 lines 66-column 25 line 2).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Nye et al. and Collins by electroplating the nickel layer followed by the gold layer as taught by Love et al., because plating the nickel layer prevents any solder-copper chemical interactions and plating the gold layer on the nickel layer protects it from environmental corrosion and attack.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nye et al. in view of Collins, and further in view of Srivastava et al.

Nye et al. and Collins teach the method as described above in addressing claim 1. Nye et al. also teach using an electrically conductive layer 60 (figure 3) to form the interconnection pad. The difference between the reference to Nye et al. and the instant claims is that the reference does not explicitly teach the interconnection pad comprises of aluminum.

Srivastava et al. teach that the interconnection pad can be composed of copper or aluminum metal pad or line (column 2 lines 36-39).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Nye et al. and Collins by using the aluminum pad of Srivastava et al., because aluminum is a good electrical conductor and is well suited for forming the interconnection pad.

Response to Arguments

Applicants' arguments have been considered but are moot in view of the new ground(s) of rejection.

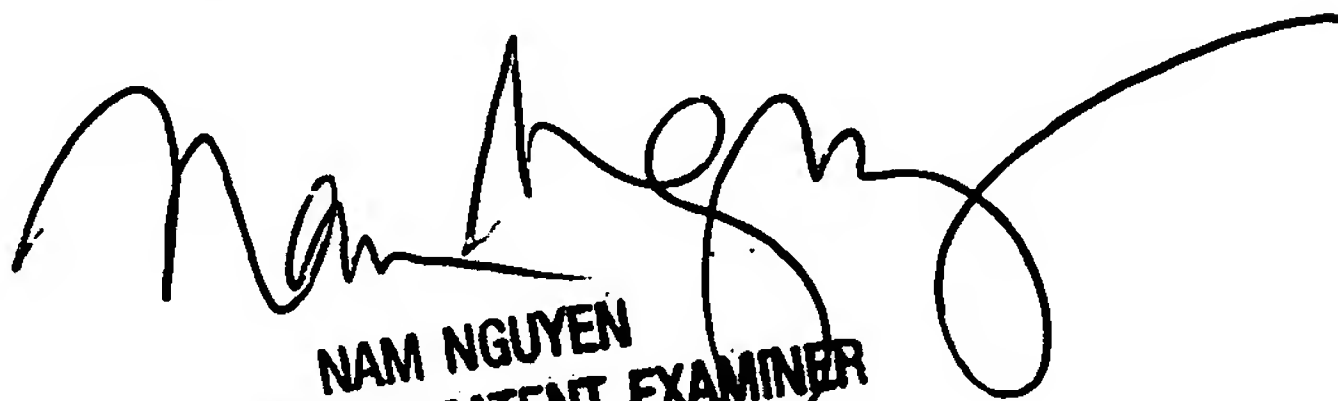
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luan V. Van whose telephone number is 571-272-8521. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LVV
April 28, 2006


NAM NGUYEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700